Performance of TOPEX/Poseid on "Quick-Look" Precision Orbit Determination in the Extended Mission

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TOPEX/Poseidon is a joint American/French ocean topography experiment conducted by the National Aeronautics and Space Administration (NASA) and the Centre National d'Etudes Spatiales (CNES). It was launched by an Ariane 42p launch vehicle on August 10, 1992 to study ocean circulation and its interaction with the atmosphere, to improve our knowledge of climate change and h cat transport in the ocean, and to study the marine gravity field. These objectives arc accomplished through accurate mapping of the ocean surface with a dua]-frequency on-board radar altimeter and precision orbit determination. The sea level is measured with a n unprecedented accuracy such that small-amplitude basiJ1-wide sca level changes caused by large-scale ocean circulation can be detected. To take advantage of the quality of these measurements, the satellite orbit radial component must be known to better than a deci meter. Precision Orbit Ephemerides (POEs) arc created at the Goddard Space Flight Center (GSFC) once per ten-day ground track repeat cycle, thirty days after the tracking data have been collected using Satellite Laser Ranging (S1.1{) tracki ng and the French Doppler orbit ography and Radio-positioning Integrated by Satellite (1101<1S) Doppler tracking system receiver. These orbits are used for the construction of the mission Geophysical Data Records (GDRs).

To aid some constituents of the science data user community, i t became evident shortly after launch that some precision orbits could be generated sooner than the POEs. These daily-fit orbits arc called Medium Precision Orbit Ephemerides (MOEs) and arc constructed 3-5 days after-the-track. initially, SLR data was used to construct t h c MOEs, and later, as the SLR data has reduced due to shrinking funding fOr the SLR network, tracking, from the experimental Global Positioning System Development Receiver (GPSDR) was added. These "quick-look" MOEs arc u sed in support of the Interi m Geophysical Data Record (IGDR) production.

The production of the MOEs is the responsibility of a small team within the Flight Operations System (FOS), referred to as the Precision orbit determination and Verification Team (PVT). The PVT also receives the POE from GSFC and performs a verification procedure before delivery to the Science Data Team (SDT).

The satellite has just completed the first year of a three year extended mission. This year has been characterized by a flight team operating with minimal resources, two satellite safeholds, reduction in SLR data, and some GPSDR problems. This paper addresses these shortcomings and their impact on the precision orbit determination process. The paper also presents a performance summary of the "quick-look" MOE orbit determination and the POE verification activities conducted by the PVT this last year.

Specifically, the paper first presents the present task configuration. Changes implemented after the prime mission are then discussed. Four areas of statistical performance are emphasized and presented in detail

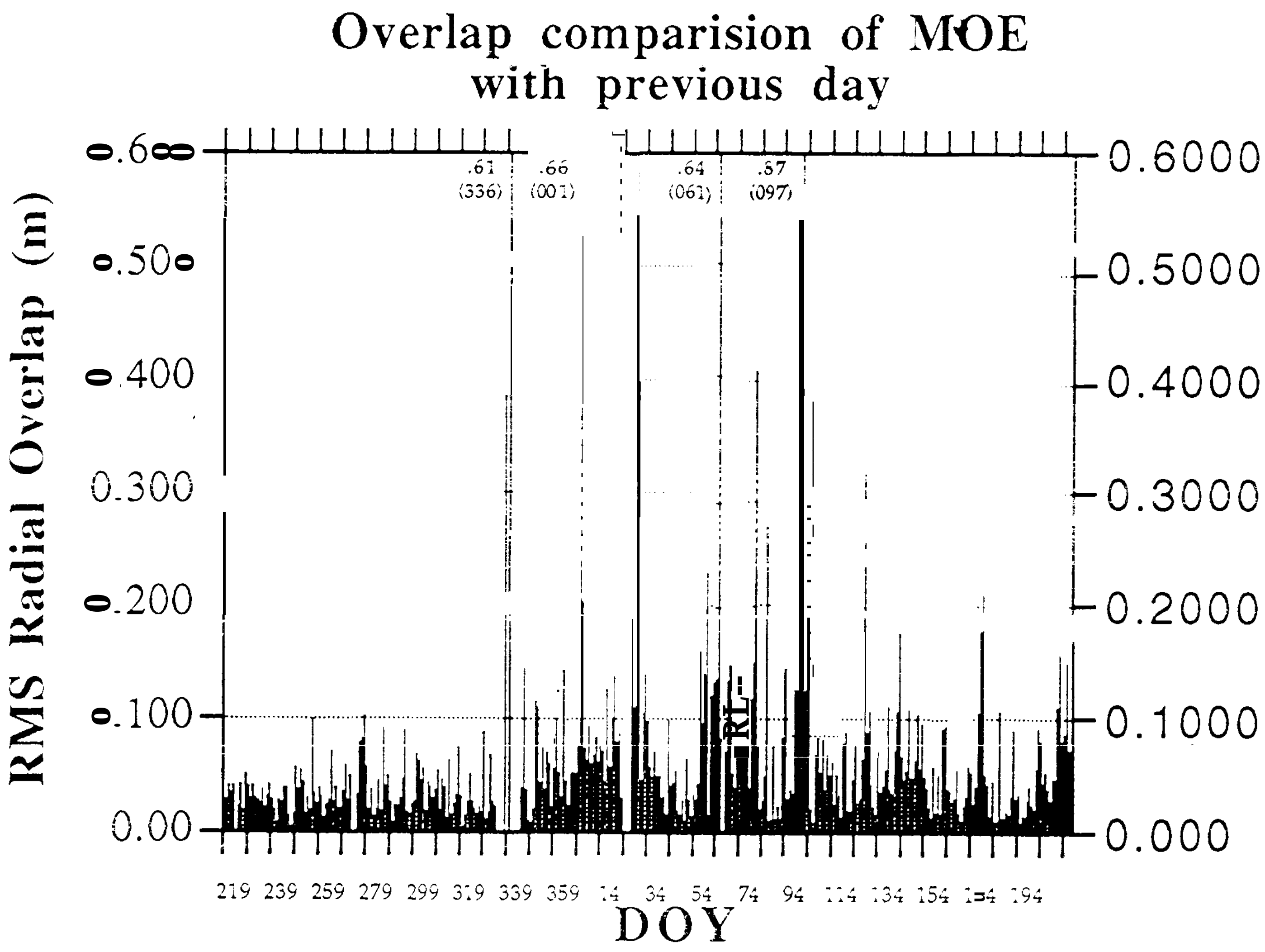
1. Overlap comparison of current MOE with that of the previous day: An example is shown in Fig (1). The paper discusses the reasons contributing to the large overlap errors in the figure.

2, Overlaps between GSFC POE and JPL MOE: Figure (2) shows an example of such comparison. Large differences are also discussed in the paper.

3. Radial orbit differences derived from altimeter crossovers: An example is shown in Fig (3).

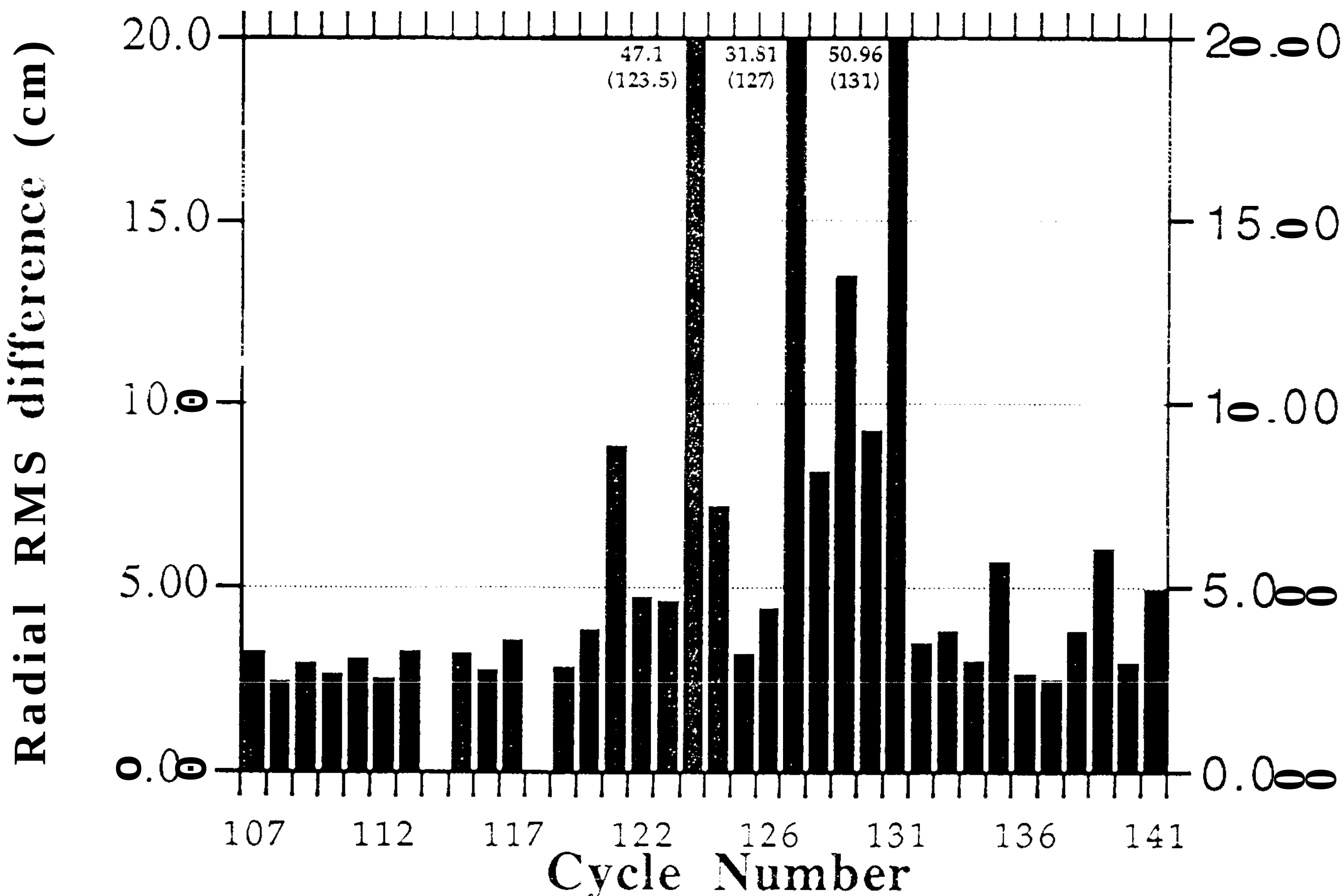
4, statistical performance and difference between various data combination scenarios used to produce the MOE

Finally, the paper addresses problems encountered and lessons learned.



Overlap comparision of MOE
with previous day
RMS Radial Overlap (m)
0.600
0.500
0.400
0.300
0.200
0.100
0.00
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.000
.61
(336)
.66
(001)
.64
(061)
.87
(097)
RL--
219 239 259 279 299 319 339 359 14 34 54 74 94 114 134 154 174 194
DOY

Overlaps Between NASA POE Orbits and JPL MOE Orbits



GPS Precision Orbit Determination at JPL

TOPEX/Poseidon Orbit Comparisons: GSFC - JPL